

serious work began. He starts at once (p. 19) with the interesting observation that the coarse auriferous gravels near Sintang show that the carrying power of the rivers was formerly greater; and the explanation is found in the greater height of the ranges of the interior in late Cainozoic times. The author returns to these deposits in his valuable geological summary (pp. 453-9), where he states his conclusion that Borneo has undergone continuous degradation, through atmospheric action, in the Quaternary era. The products of decay have encroached on what was in earlier times a shallow sea, broadening the land, and connecting island after island with the central mass by new deposits of alluvium. At the same time, the alluvium has accumulated on the decaying ranges, burying their lower slopes in material which they themselves supplied. In opposition to the elevation-theory of Posewitz, Molengraaff sees in the growth of the river-deposits the real cause of the post-Pliocene extension of Borneo.

From Sēmitau, higher up the Kapoewas, the author diverged through the thick forest, up a side-stream to Mount Kēnepai. This is a steep mass 1136 m. above the sea, carved out of granite injected by andesite, the granite (p. 432) being of post-Jurassic age. Still more interesting igneous features are seen in the next range visited, on the Mandai River, where huge horizontal beds of volcanic tuff give rise to "table-mountains" bounded by vertical rock-walls. Molengraaff (p. 65) names this range the Müller Mountains, after the murdered explorer Georg Müller, who is believed to have penetrated the area. The volcanic action that here poured out rhyolite and andesite and abundant tuffs along an east-and-west line in Central Borneo was probably post-Cretaceous (p. 441), and may have continued throughout Cainozoic times. The range is now known to extend over at least 280 km., and has doubtless (p. 445) an important relation to the post-Cretaceous movements of the land. Have we here, indeed, unexpectedly revealed by Molengraaff, one of those volcanic chains that accompany the Eurasian "Alpine" system of folding? The author shows how the Müller Mountains have been piled on sunken land (p. 445), which has been lowered by east-and-west faults from the south flank of the Upper Kapoewas range. This old range, the slates of which are possibly of Palæozoic age, was at one time covered by Jurassic rocks, the age of the latter being determined by Dr. Hinde's observations on the radiolaria. These rocks, now preserved by the downward faulting in the lake-district north of Sēmitau (pp. 123 and 414), are grouped by Molengraaff as the "Danau formation." The faulting has affected the "Eocene" sandstone strata, which once spread across the folded Cretaceous and Danau systems, and terminated somewhere on the flanks of the Upper Kapoewas chain. The plain of the Upper Kapoewas River was thus determined by the downthrow of the Danau beds in Middle Cainozoic times, whereby the chain of mountains to the north was more than ever emphasised. While intrusions of granite had already (p. 449) accompanied the post-Jurassic and pre-Eocene movements, the volcanic line of the Müller Mountains made its appearance along one of the Middle Cainozoic faults.

In the eyes of Suess ("Antlitz," Bd. iii., pp. 312, 315, and Tafel xi.), the Upper Kapoewas range forms part of a great bow extending southward from the Philippines, and the volcanoes have arisen on the faulted outer side.

The association of radiolarian cherts with diabase and diabase-tuff, as described so often by the author, seems almost inevitable, although the beds in Borneo are of Jurassic or early Cretaceous age. Mr. J. J. H. Teall has discussed this phenomenon; and it seems independent of geological age. One is reminded of Anglesey, where Mr. Greenly (*Quart. Journ. Geol. Soc.*, 1902, p. 433) has been led to consider the cherts as of organic origin, on account of their association with "pillowy diabase"—so firmly has the connection of these two types of rock, however improbable at first sight, become established in recent years as an article of geological belief.

We must merely mention the interesting ascent of Mount Kēlam, a strangely smooth boss of pre-Cretaceous microgranitic rock, the surface of which (p. 138) peels off like the layers of an onion, as in the instances studied by Branner in Brazil. It soon becomes clear to the reader that Central Borneo is rich in a variety of mountain-forms. While Dr. Molengraaff's landscapes will interest the geographer and the artist, other illustrations are of ethnographical value. The chapter on river-curves (p. 473) introduces a new term, "pintas," the Dyak name for a natural short-cut formed across the loop of a meandering stream. Unfortunately it has no convenient European plural, or it might be of much service in geography.

Dr. Hinde's important appendix is already known to palæontologists. The English in the translated part of the volume is, as a whole, clear and carefully printed. The two misprints in the title of plate lii. should, however, have been avoided, but are more than balanced by the action of the English binders, who have curtailed the author's name on the exterior of both the volumes. Dr. Molengraaff has added so much to our knowledge of a difficult country, especially in regard to its tectonic history, that we trust that political disturbances have not removed him permanently from another field of observation, where his work was only just begun.

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#### PROCEEDINGS OF THE GERMAN ZOOLOGICAL SOCIETY.

*Verhandlungen der deutschen zoologischen Gesellschaft, xii. Versammlung, Giessen, 1902. Pp. iv + 221. (Leipzig: Engelmann, 1902.)*

THE German Zoological Society consists of about 240 experts, who meet in variable numbers for two or three days annually in some happily chosen hospitable spot, where they hold high discourse. There were only about sixty members present at last summer's (twelfth) meeting in Giessen, but the Society, if not large in numbers, is strong in quality. It is not pecuniarily rich, for it has backed out of more than an honorary responsibility with regard to one of its offspring—an expensive child—"Das Tierreich," which the Berlin Academy of Science will henceforth solely foster, but it is rich in enthusiasm, as we infer

from the proposal to segregate into entomological, ornithological and other sections. Long may it live and thrive, and continue to publish its interesting proceedings, which we have just been enjoying. The volume, ably edited by Prof. Korschelt, contains a general introductory address by Prof. Chun; a welcome from Prof. Hansen, as rector of the University of Giessen; a short reminiscence, by Prof. Spengel, of the zoologists who have taught and wrought at Giessen, *e.g.* Leuckart, Schneider and Ludwig; and about sixteen papers, most of which impress us with their general interest, their lucidity and their brevity.

We may arrange the papers in groups:—(1) *Ecological*.—Prof. A. Brauer gives an account of the so-called “telescopic” eyes of some deep-sea fishes from the *Valdivia* collection. These eyes tend to be tubular, with wide pupil, reduced iris and very convex cornea. They show a dimorphic retina, the main part at the back of the eye being very different from the accessory part (“Nebenretina”), which is usually medio-dorsal, near the lens, and perhaps adapted for the perception of more distant objects. Brauer notes that the adaptations of the eye in these deep-sea fishes are all of the plus and minus order; the eye is a very conservative organ as regards essential architecture. Prof. J. Vosseler gives an account of the protective adaptations of North African Orthoptera, paying particular attention to the odoriferous vesicle beneath the pronotum of *Cedaleus nigrofasciatus* and *Ce. senegalensis*, and to the blood-spraying apparatus between coxa and trochanter on the legs of the Heterodid *Eugaster guyoni*. Dr. L. Reh discusses the importance of zoological study in regard to plant-protection. In a profoundly interesting paper, E. Wasmann describes the various adaptations (mimetic, symphilous, &c.) of the Staphylinid guests of Doryline ants, the striking convergence between some Neotropical and some Ethiopian myrmecophils, the particular case of *Mimeciton* to which he awards, as he well may, “the palm of mimicry,” and the very suggestive occurrence of what he calls *exaggerated mimicry*. In another paper, the same author shows that the habit of rearing larvae of Lomechusids (especially of *Lomechusa strumosa*) is responsible for bringing about that strange phenomenon of inhibited female development (the thorax of a female combined with the abdomen and size of a worker) called *pseudogyny*.

(2) *Morphological*.—Prof. C. Chun has traced the development of the chromatophore of the octopus *Bolitaena* from a small mononucleate cell, through stages with 2, 4, 8, 16, 32 nuclei. There is a large peculiar nucleus in the centre of the pigmented mass; the other smaller nuclei lie peripherally at the bases of the contractile processes. The accompanying figures are very striking. Prof. F. Vosseler finds that an intestinal villus may have a slit-like apical *aperture*, and sometimes a more lateral one in addition. The stroma of the apical region is sometimes cleanly retracted from the enveloping epithelium, so that a cap-shaped space is left with some *débris* and leucocytes. Prof. R. Hesse shows that the truly optic, rod-possessing cells of the Gasteropod retina may be with or with-

out pigment; sometimes the optic cells are pigmented while the indifferent cells are pigmented; sometimes the converse occurs; and in the “Nebenretina” of *Limax* there is no pigment at all. Gräfin M. von Linden describes in the pupa of *Papilio podalirius* fine projecting hairs, connected through the chitinous sheath, with nerve terminations lying *outside* the epithelium of the body, which again are connected with sub-epithelial nerve strands.

Dr. B. Wandolleck figures the *two-jointed* styles of the female of *Lagria hirta*, thus answering Verhoeff's objection that styles cannot be truly appendicular because always unjointed. Prof. C. B. Klunzinger describes *Ptychodera erythraea*, Spengel, an interesting Enteropneust from the Red Sea, with very large genital flanges (Flügel). Dr. J. Meisenheimer notes the resemblances between the early development of *Ammonothea echinata* and that of many Entomostraca, and also the resemblances between the “protonymphon” larva and the nauplius. He concludes that the relationship between Pantopoda and Crustacea is much closer than Dohrn would admit. Dr. F. Schmitt describes the gastrulation of double embryonic primordia in the blastoderm of the trout, and shows that the duplicity cannot be interpreted on the concrescence theory without accessory hypotheses.

(3) *Physiological*.—Dr. H. Jordan's experiments on *Astacus* confirm the conclusion that the mid-gut gland, besides secreting digestive juices, has a very important absorptive function. It is physiologically, as well as embryologically, just an evagination of the mid-gut.

(4) *Ætiological*.—Prof. W. J. Palacký revolts from the zoogeographical regions of Sclater and Wallace, and maintains that the useful task now is to take class by class, and to correlate present distribution with all that geology has to tell us of the past. Prof. H. Simroth has a remarkable paper in which he applies the “pendulation theory” to the problems of biogeography. In another paper Simroth excels himself in bold speculation, but we are quite unable to follow his elliptical argument, which, as might have been expected from the ingenious author of “Die Entstehung der Landtiere,” is a glorification of the evolutionary advantages of *terra firma*. He seeks to show that everything worth having, *e.g.* a head and a vertebrate body, and striped muscles and sexual reproduction, must have been evolved on land. He seems to derive the Sponges from terricolous *Acœla*, and these form Infusorians, and so on until we land in Probacteria and the organic matter which preceded life. It reads like a recrudescence of “Naturphilosophie.”

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#### ANCIENT AND MODERN ENGINEERING.

*Ancient and Modern Engineering and the Isthmian Canal.* By Prof. William H. Burr. Pp. xv+473. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 1902.) Price 14s. 6d. net.

THIS is an English edition of a book published in America, and contains the outcome of six lectures delivered at the Cooper Union in New York, under the auspices of Columbia University. The first part deals